Mitigating Erosion Along Sheltered Coasts

A report of the National Academies

...and some related information

Debra Hernandez

President

Hernandez and Company, LLC

Sponsors



Statement of Task (condensed)

The study will examine the impacts of shoreline management on sheltered coastal environments and identify strategies to minimize impacts to coastal resources.

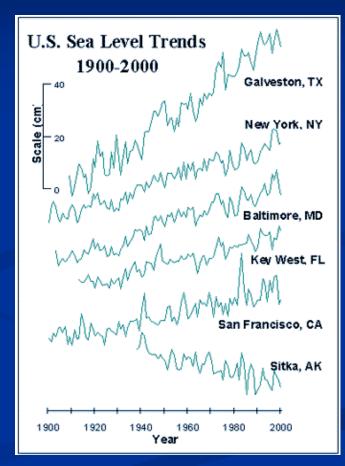
The study will provide a framework for **collaboration** between different levels of government, conservancies, and property owners.



The Problem

- Increasing development
- Vulnerability to chronic land loss from erosion and sea level rise

Reliance on hard structures to prevent land loss

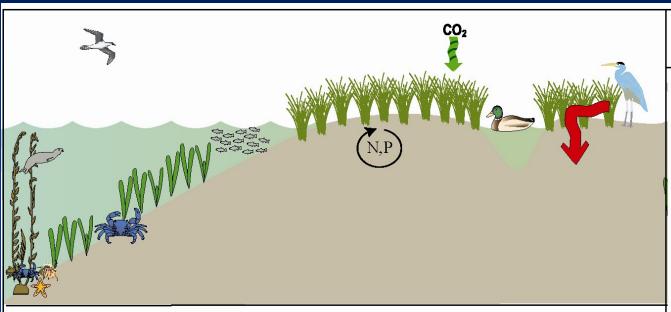


Geomorphic Settings

Three major categories:

- Beaches and dunes
- Mudflats and vegetated communities (marsh, macroalgae, seagrasses, etc.)
- Unconsolidated bluffs

Ecosystem Services - Marshes



Importance and Features







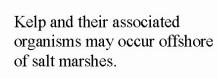
Salt marshes provide important nursery habitat for crabs and fishes.

Salt marshes act as a nutrient filter and is the site of nutrient cycle.

Salt marshes support high primary production.



Seagrasses may or may not occur adjacent to marshes.



Icon Key



native marsh grass



birds and waterfowl



kelp



sea otter



kelp associated fauna

Strategies for Addressing Erosion

- Harden
- Vegetate
- Trap and/or add sand
- Manage Land Uses
- Combination of one or more





Design Criteria

Top: Stone revetment built with only one layer of undersized armor stone on too steep a slope.

Bottom: failure after a modest storm event.

Source: Hardaway and Byrne, 1999

Findings and Recommendations

- 1. Information Needs
- 2. Erosion Control Options and Permitting
- 3. Cumulative Effects
- 4. Shoreline Management Planning

1. INFORMATION NEEDS

FINDING:

Information on causes of erosion in the broader region (estuary, lagoon, littoral cell) is insufficient.

RECOMMENDATION:

Federal agencies (e.g., USACE, EPA, USGS, and NOAA), state agencies, and coastal communities should support studies to facilitate decision making based on the coastal system rather than individual sites.

1. INFORMATION NEEDS

These studies should:

- Identify trade offs in ecosystem services associated with various mitigation measures,
- Quantify the costs and benefits of erosion control techniques,
- Document system-wide processes, including mapping of erosion zones and rates.
- Present information in non-technical formats such as summary maps.
- Develop models to predict the evolution of coastal features under various scenarios.

2. EROSION CONTROL OPTIONS AND PERMITTING

FINDINGS:

- Compared to open coasts, a greater variety of techniques are available to address erosion in sheltered areas
- New techniques (or structural materials) require a rigorous process of testing and evaluation to determine their effectiveness and evaluate their environmental impacts
- ➤ The current permitting system discourages the use of alternatives to shoreline hardening

2. EROSION CONTROL OPTIONS AND PERMITTING

RECOMMENDATIONS:

- EPA, USACE, and NOAA should initiate a dialogue to bring decision-makers together to share information on the potential use of different erosion mitigation approaches.
- > The dialogue should result in guidelines for mitigating erosion that give deference to ecologically beneficial measures and ensure consistency of decision-making across regions.
- > The regulatory preference for permitting bulkheads and similar structures should be changed to favor more ecologically beneficial solutions.
- State and federal regulatory programs should establish a technical assistance function.

3. CUMULATIVE EFFECTS

FINDING:

The cumulative impact of the loss of many small parcels will at some point alter the ecosystem. In addition, the economic, recreational, and esthetic properties of the shoreline will change. These cumulative effects of shoreline hardening projects are rarely assessed.

RECOMMENDATION:

Shoreline management plans should account for potential cumulative effects of shoreline hardening. In the absence of information, a precautionary approach should be taken.

4. SHORELINE MANAGEMENT PLANNING

FINDINGS:

- Many factors in addition to sediment budgets must be considered in the development of regional plans including socio-economic and ecological factors.
- Regional plans could be implemented under the federal Coastal Zone Management Act (CZMA), Section 309 - Special Area Management Plans, to ensure that federal permitting actions are consistent with the plan.
- The USACE Regional Sediment Management program provides a model for regional planning that matches the scale of planning effort to the scale of the processes and impacts.

4. SHORELINE MANAGEMENT PLANNING

RECOMMENDATION:

Regional shoreline management plans should be developed by local, state, and federal partners to address erosion in a comprehensive, proactive manner and avoid the unintended loss of recreational, aesthetic, economic, and ecological values.

In Summary

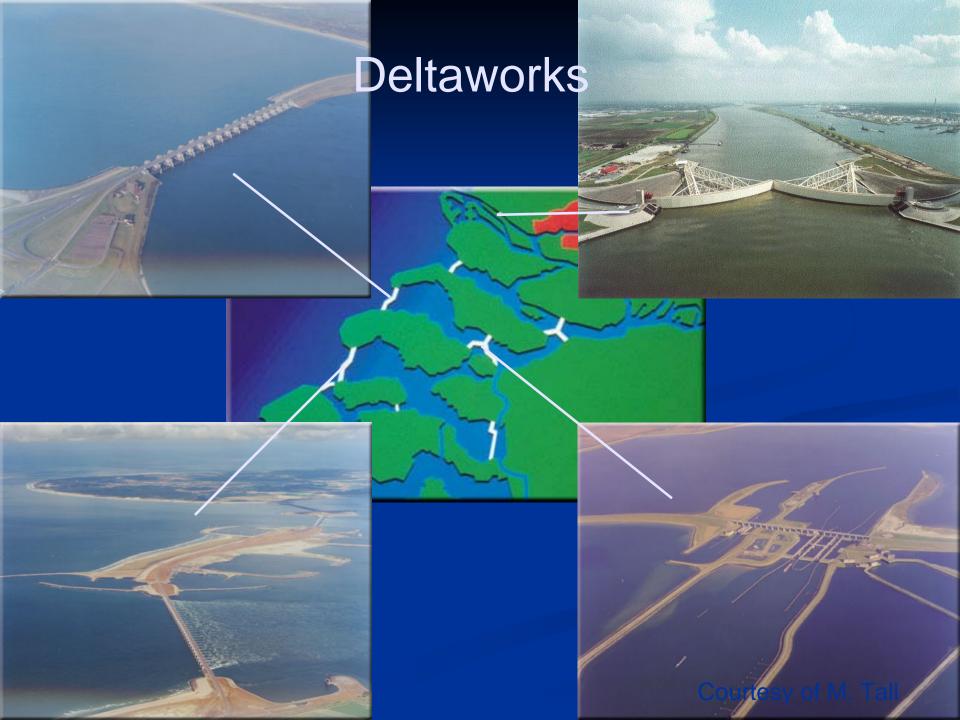
- > Information on shoreline change is insufficient
- Decision makers (landowners, contractors, local and state authorities) are generally unaware of alternative erosion mitigation options
- Individual decisions lead to cumulative impacts
- > All mitigation measures affect ecosystem services
- Local, proactive shoreline management plans could prevent unintended consequences of siteby-site permitting
- Permitting systems should promote mitigation approaches that maintain more natural shorelines

U.S. Army Corps Coastal Engineering Research Board's (CERB)

Flood-Mitigation Fact-Finding Mission to the EU

- **CERB** Chair:
 - Major General Don Riley (Director of Civil Works)
- **CERB Members:**
 - BGs Greg Martin (NWD Commander), Joe Schroedel (SAD), Todd Semonite (NAD)
 - Drs. Joan Oltman-Shay, Bruce Taylor, Richard Seymour





National approaches to flood mitigation – Netherlands (1)

- While implementing their 50-year Delta works projects, in response to the 1953 flood, they learned that
 - The "protection" in "flood protection" is a misnomer
 - Flood risk mitigation is more realistic
 - The solutions need to be integrated and address both flood risk reduction and environmental needs
 - They were glad it took 50 yrs to build the Delta projects because they learned and adapted along the way
 - "Use steel and concrete where you must, but sand, sediment, and eco-engineering where you can."
 - Apply "incremental adaptive management/restoration (methods) – an adaptive strategy allows for greater flexibility in the future"

Definition: Adaptive Management

- Working with the natural system to:
 - Allow beneficial natural processes to occur
 - Define extremes and forecast trends in light of best climate change predictions
 - Accommodate significant linkages with other systems through both structural and nonstructural solutions
 - Consider sediment as a manageable and valuable resource
 - Adapt and adjust to changing climate

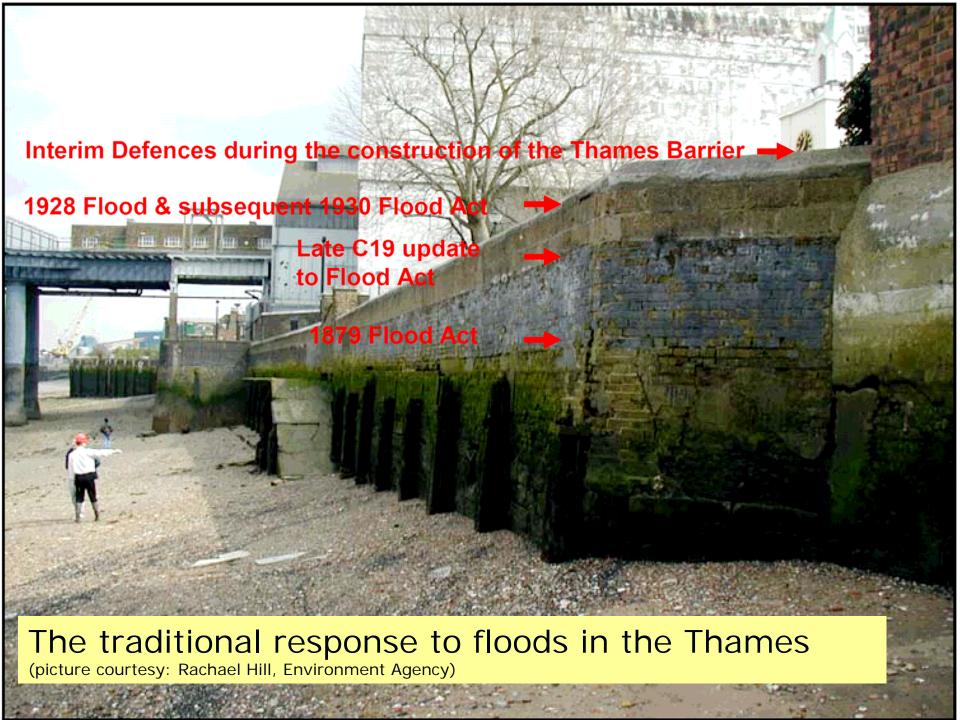
National approaches to flood mitigation – Netherlands (2)

- Their 50-year flood protection project also taught them
 - Protection cannot be at the cost of the ecosystem without economic and humanitarian consequences
 - "Mother Nature is the best engineer, think twice before you interfere"
 - "Put Mother Nature on the team"

National approaches to flood mitigation – Netherlands (3)

- The Dutch have recently recognized that a concern comparable to storm surge at the coast is flooding from the watershed
 - Managing river flooding requires cooperation with other countries upstream
 - Flooding from rivers is expected to increase because of climate change
 - The system solution needs to "make room for the river"
 - Areas are now designated for occasional flooding





Another Dutch Quote

- "Lord give us this day our daily bread and every once in a while a flood ...so people are reminded of the risks they still face"
 - Marcella Laguzzi, Head Section Flood Protection, Province South Holland
- > Translation Complacency is one of our greatest foes